V_{CE} = 3300 V
I_C = 250 A

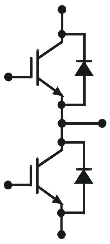


ABB HiPak™

IGBT Module
5SNG 0250P330300

Doc. No. 5SYA 1406-00 Aug 10

- **Ultra low loss, rugged SPT⁺ chip-set**
- **Smooth switching SPT⁺ chip-set for good EMC**
- **High insulation package**
- **AlSiC base-plate for high power cycling capability**
- **AlN substrate for low thermal resistance**

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, $T_{vj} \geq 25$ °C		3300	V
DC collector current	I_C	T_c = 80 °C		250	A
Peak collector current	I_{CM}	t_p = 1 ms, T_c = 80 °C		500	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_c = 25 °C, per switch (IGBT)		1950	W
DC forward current	I_F			250	A
Peak forward current	I_{FRM}			500	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave		2300	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 2500 V, $V_{CEM\,CHIP} \leq 3300$ V $V_{GE} \leq 15$ V, $T_{vj} \leq 125$ °C		10	µs
Isolation voltage	V_{isol}	RMS, 1 min, f = 50 Hz		6000	V
Junction temperature	T_{vj}			125	°C
Junction operating temperature	$T_{vj(op)}$		-40	125	°C
Case temperature	T_c		-40	125	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques [2)]	M_s	Base-heatsink, M6 screws	4	6	Nm
	M_{t1}	Main terminals, M6 screws	4	6	

1) Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
2) For detailed mounting instructions refer to ABB Document No. 5SYA2039

ABB

IGBT characteristic values [3)]

Parameter	Symbol	Conditions		min	typ	max	Unit
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 10 mA, T_{vj} = 25 °C		3300			V
Collector-emitter [4)] saturation voltage	$V_{CE\ sat}$	I_C = 250 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.4		V
			T_{vj} = 125 °C		3.0		V
Collector cut-off current	I_{CES}	V_{CE} = 3300 V, V_{GE} = 0 V	T_{vj} = 25 °C			2	mA
			T_{vj} = 125 °C		6	20	mA
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V, T_{vj} = 125 °C		-500		500	nA
Gate-emitter threshold voltage	$V_{GE(TO)}$	I_C = 40 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5		7	V
Gate charge	Q_{ge}	I_C = 250 A, V_{CE} = 1800 V, V_{GE} = -15 V .. 15 V			1830		nC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			25.3		nF
Output capacitance	C_{oes}				2.03		
Reverse transfer capacitance	C_{res}				0.63		
Turn-on delay time	$t_{d(on)}$	V_{CC} = 1800 V, I_C = 250 A, R_G = 10 Ω, V_{GE} = ±15 V, $L_σ$ = 400 nH, inductive load	T_{vj} = 25 °C		400		ns
			T_{vj} = 125 °C		400		
Rise time	t_r		T_{vj} = 25 °C		180		ns
			T_{vj} = 125 °C		195		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 1800 V, I_C = 250 A, R_G = 10 Ω, V_{GE} = ±15 V, $L_σ$ = 400 nH, inductive load	T_{vj} = 25 °C		1160		ns
			T_{vj} = 125 °C		1330		
Fall time	t_f		T_{vj} = 25 °C		270		ns
			T_{vj} = 125 °C		390		
Turn-on switching energy	E_{on}	V_{CC} = 1800 V, I_C = 250 A, V_{GE} = ±15 V, R_G = 10 Ω, $L_σ$ = 400 nH, inductive load	T_{vj} = 25 °C		330		mJ
			T_{vj} = 125 °C		425		
Turn-off switching energy	E_{off}	V_{CC} = 1800 V, I_C = 250 A, V_{GE} = ±15 V, R_G = 10 Ω, $L_σ$ = 400 nH, inductive load	T_{vj} = 25 °C		330		mJ
			T_{vj} = 125 °C		450		
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 125 °C, V_{CC} = 2500 V, $V_{CEM\ CHIP}$ ≤ 3300 V			1090		A
Module stray inductance	$L_{σ\ DC}$	between C1 – E2			125		nH
Resistance, terminal-chip	$R_{CC'+EE'}$	between C1 – E2	T_C = 25 °C		0.78		mΩ
			T_C = 125 °C		1.03		

[3)] Characteristic values according to IEC 60747 – 9
[4)] Collector-emitter saturation voltage is given at chip level

Diode characteristic values [5]

Parameter	Symbol	Conditions		min	typ	max	Unit
Forward voltage [6]	V_F	I_F = 250 A	T_{vj} = 25 °C		2		V
			T_{vj} = 125 °C		2.1		
Reverse recovery current	I_{rr}	V_{CC} = 1800 V, I_F = 250 A, V_{GE} = ±15 V, R_G = 10 Ω, L_σ = 400 nH inductive load	T_{vj} = 25 °C		300		A
			T_{vj} = 125 °C		330		
Recovered charge	Q_{rr}		T_{vj} = 25 °C		155		µC
			T_{vj} = 125 °C		250		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		730		ns
			T_{vj} = 125 °C		1260		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		165		mJ
			T_{vj} = 125 °C		280		

[5] Characteristic values according to IEC 60747 – 2
[6] Forward voltage is given at chip level

Package properties [7]

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.052	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.100	K/W
IGBT thermal resistance [2] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K		0.048		K/W
Diode thermal resistance [7] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m x K		0.096		K/W
Partial discharge extinction voltage	V_e	f = 50 Hz, Q_{PD} ≤ 10pC (acc. to IEC 61287)	3500			V
Comparative tracking index	CTI			≥ 600		

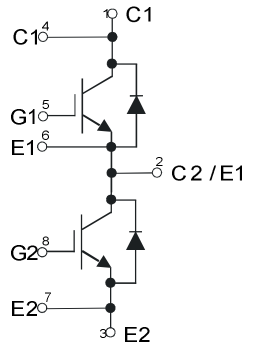
[2] For detailed mounting instructions refer to ABB Document No. 5SYA2039

Mechanical properties [7]

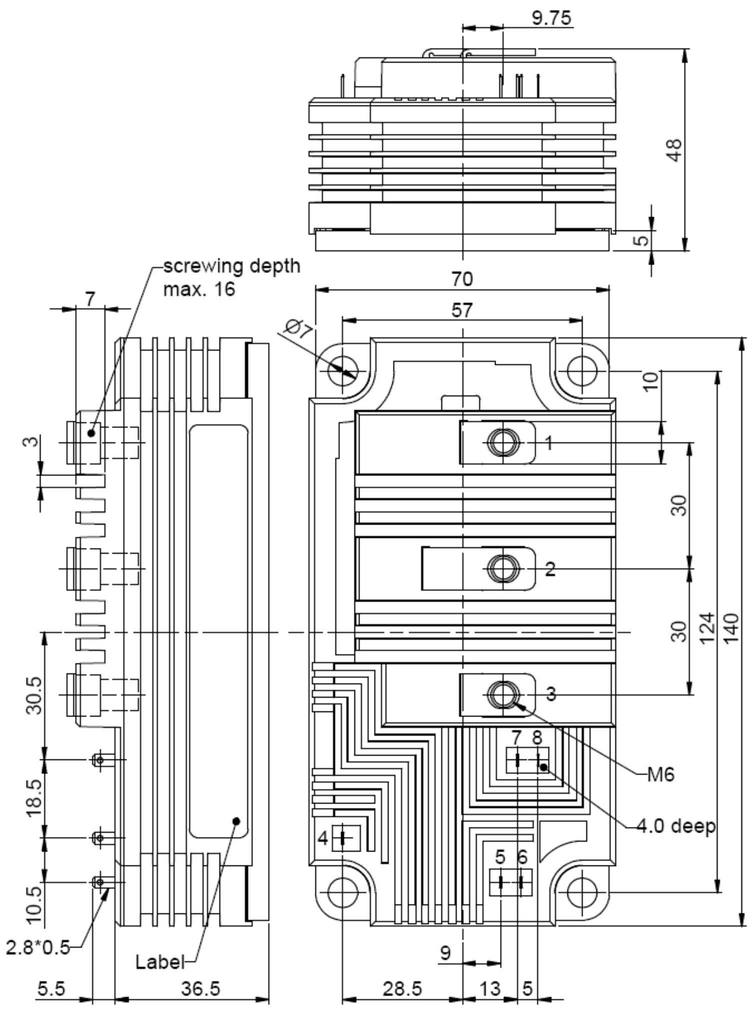
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical , see outline drawing			73 x 140 x 48		mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	35			mm
			Term. to term:	19			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	64			mm
			C1 to E1:	54			
			C1 to E2:	78			
Mass	m				620		g

[7] Package and mechanical properties according to IEC 60747 – 15

Electrical configuration



Outline drawing [2)]



Note: all dimensions are shown in mm

2) For detailed mounting instructions refer to ABB Document No. 5SYA2039

This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. IX.

This product has been designed and qualified for Industrial Level.

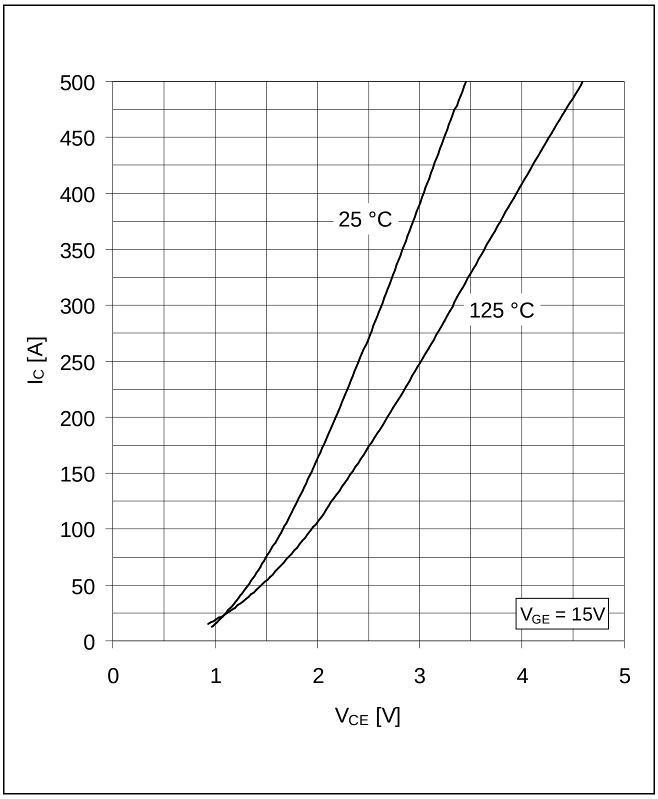


Fig. 1 Typical on-state characteristics, chip level

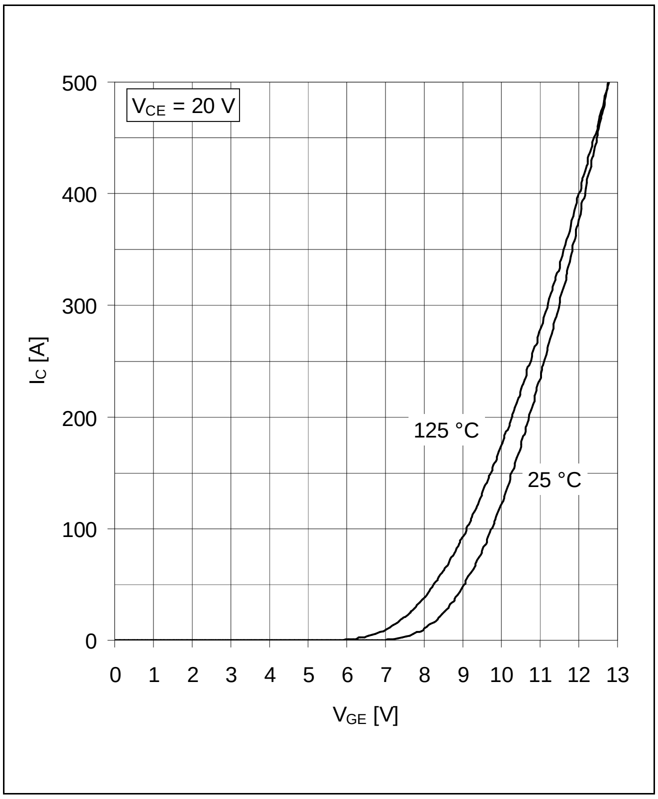


Fig. 2 Typical transfer characteristics, chip level

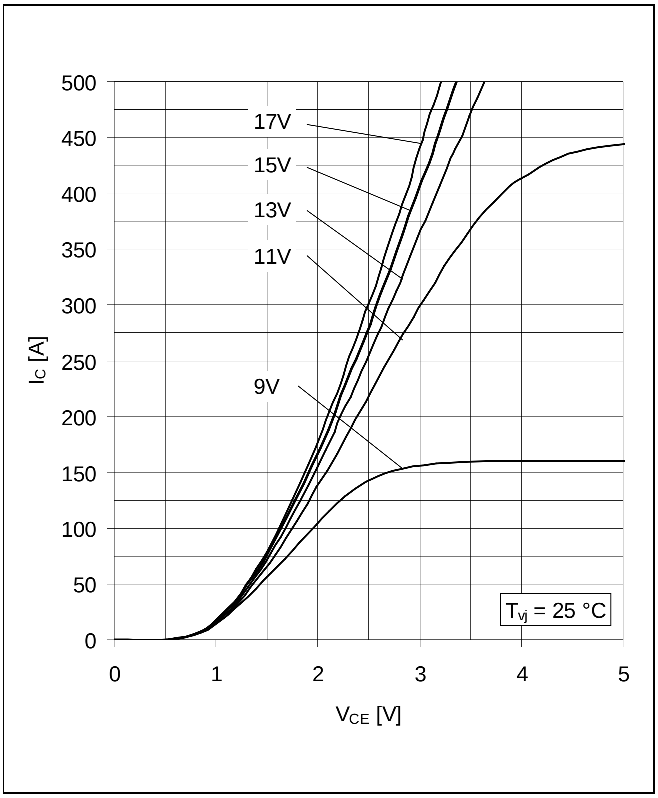


Fig. 3 Typical output characteristics, chip level

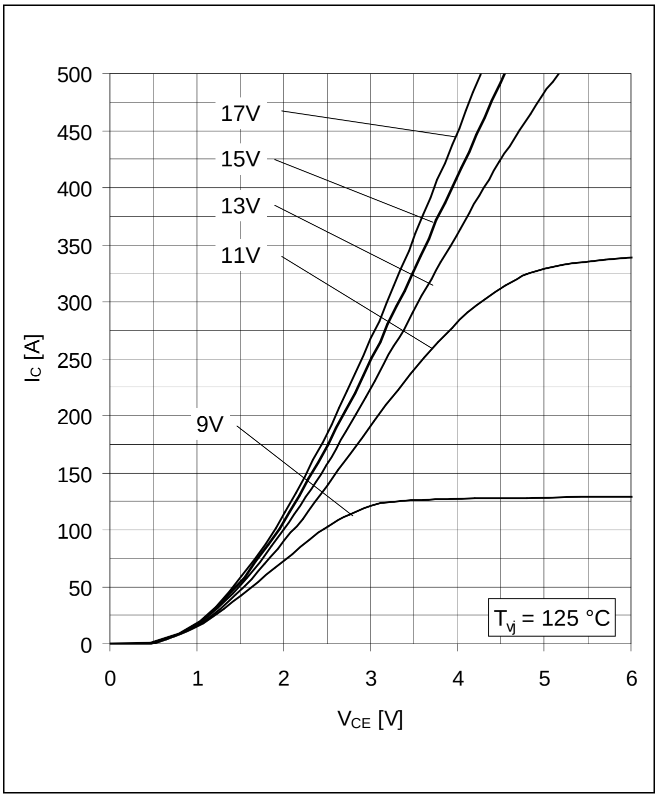


Fig. 4 Typical output characteristics, chip level

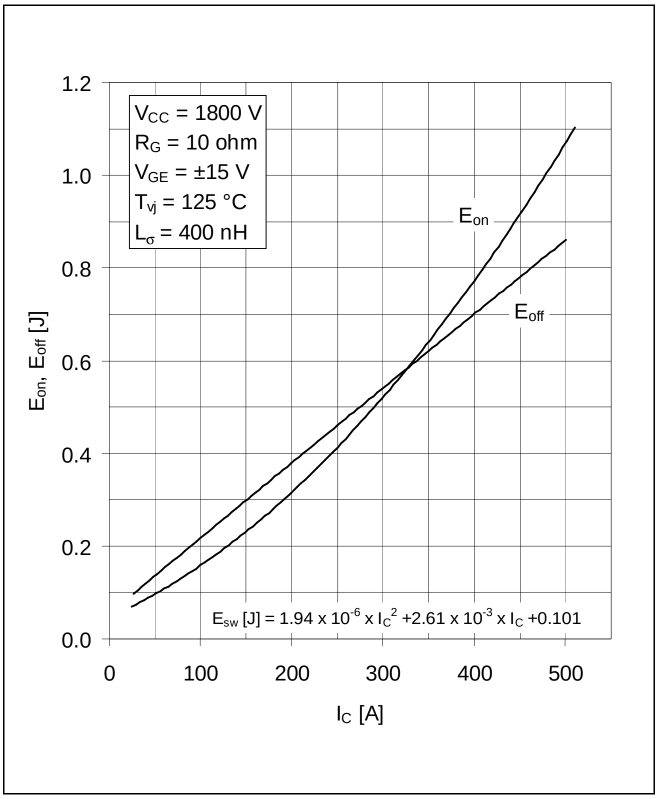


Fig. 5 Typical switching energies per pulse vs collector current

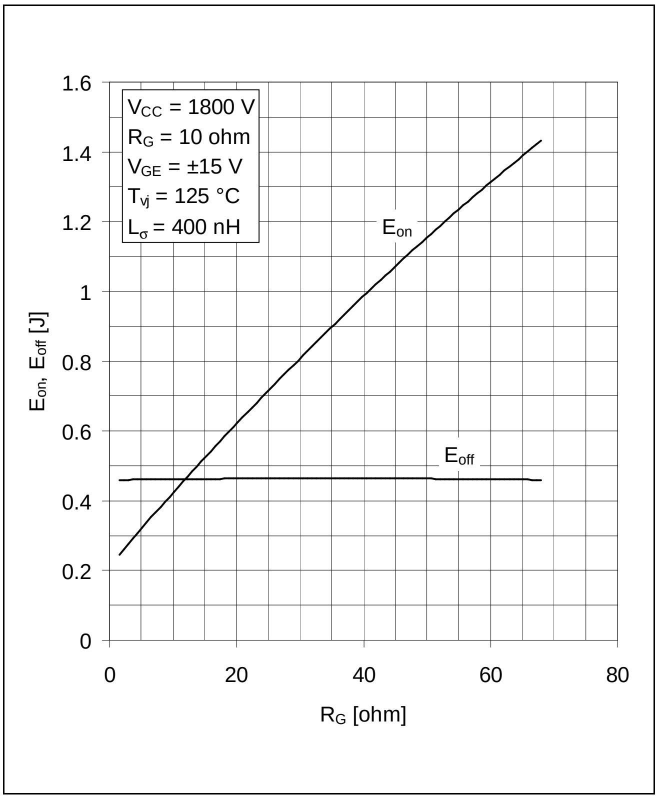


Fig. 6 Typical switching energies per pulse vs gate resistor

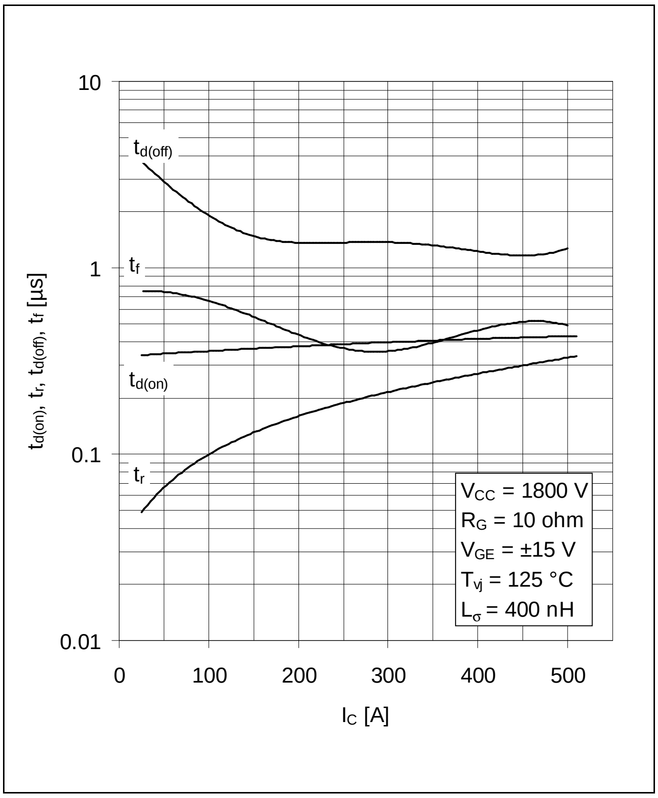


Fig. 7 Typical switching times vs collector current

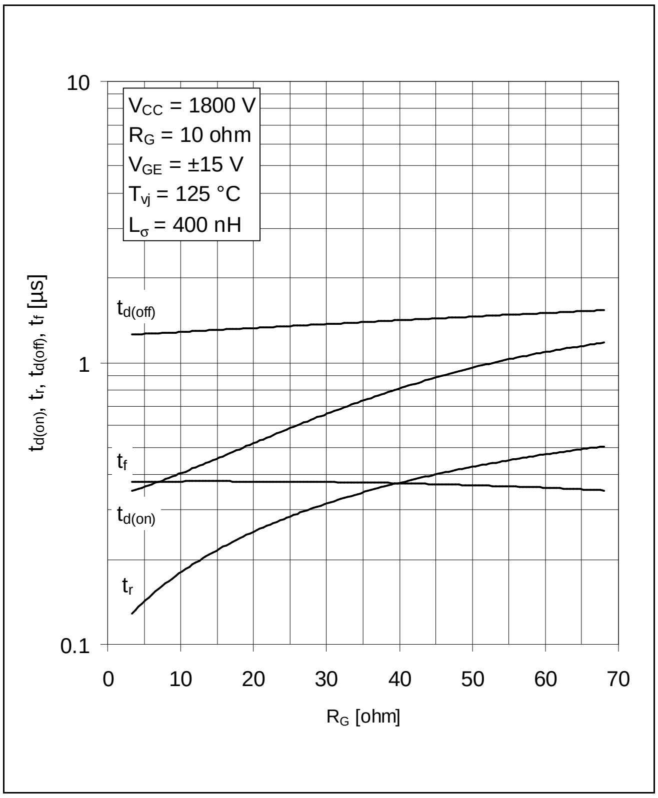


Fig. 8 Typical switching times vs gate resistor

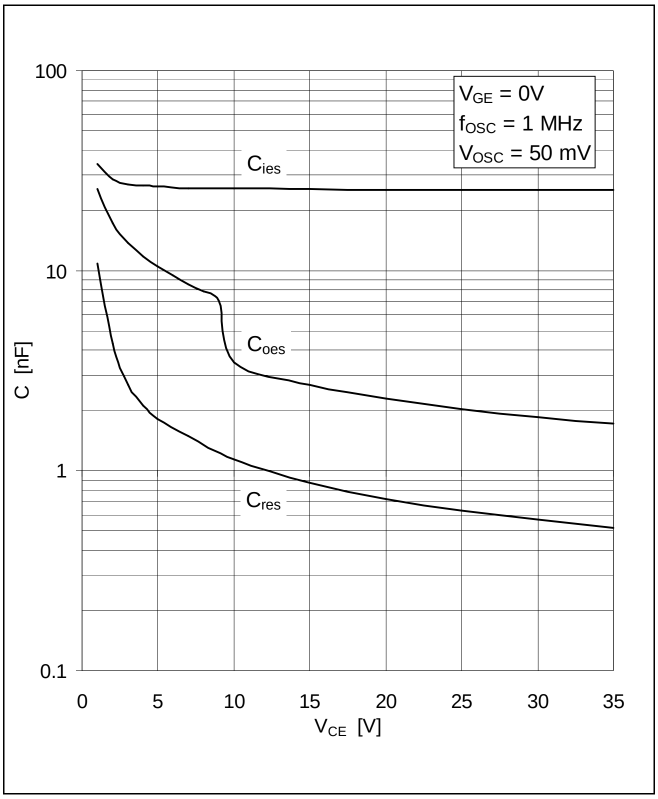


Fig. 9 Typical capacitances vs collector-emitter voltage

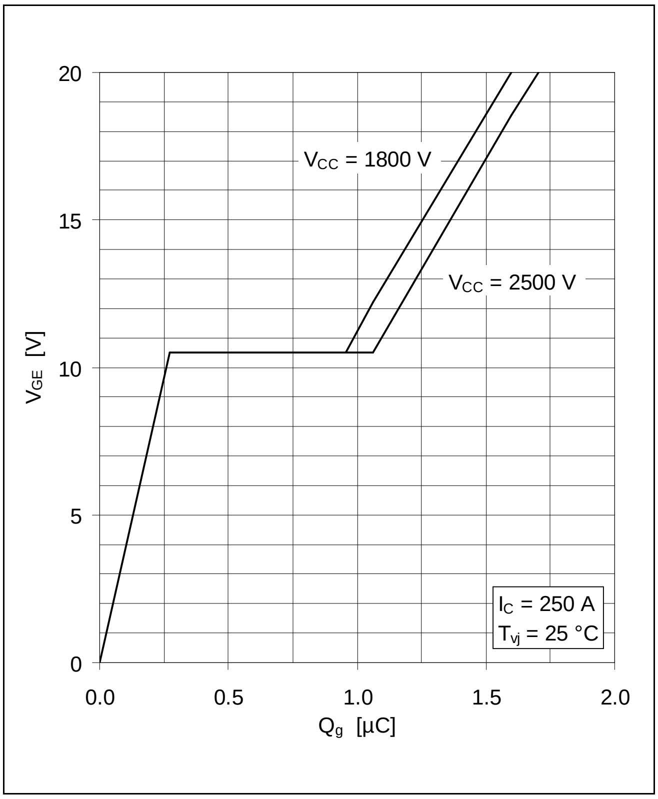


Fig. 10 Typical gate charge characteristics

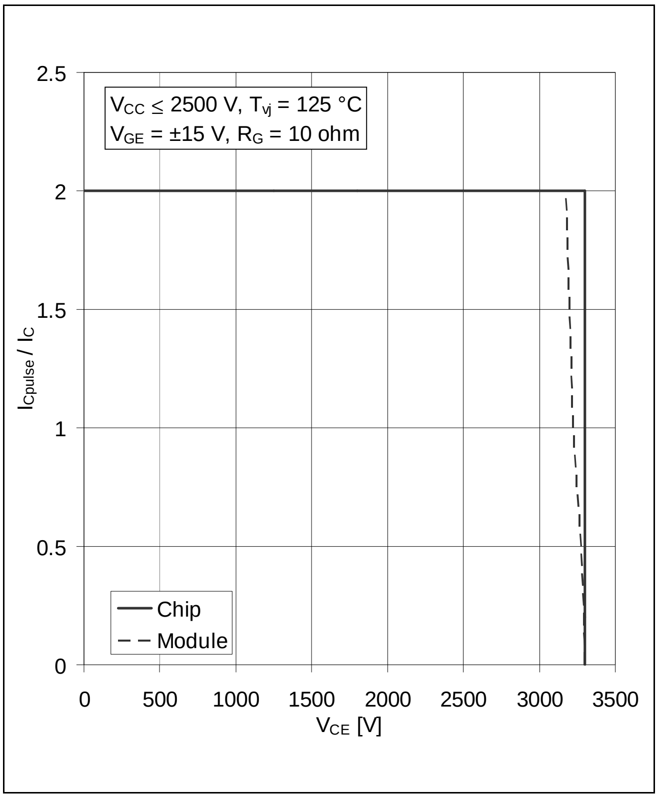


Fig. 11 Turn-off safe operating area (RBSOA)

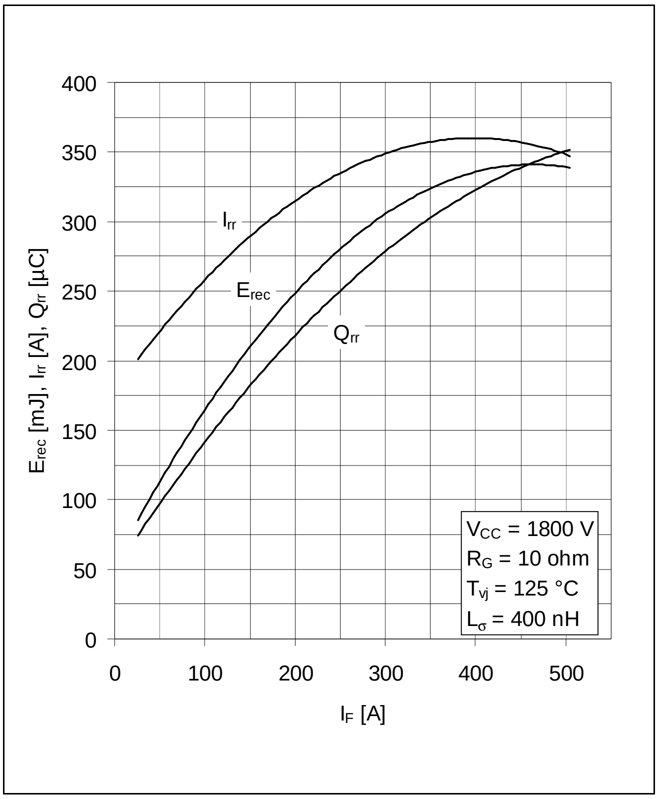


Fig. 12 Typical reverse recovery characteristics vs forward current

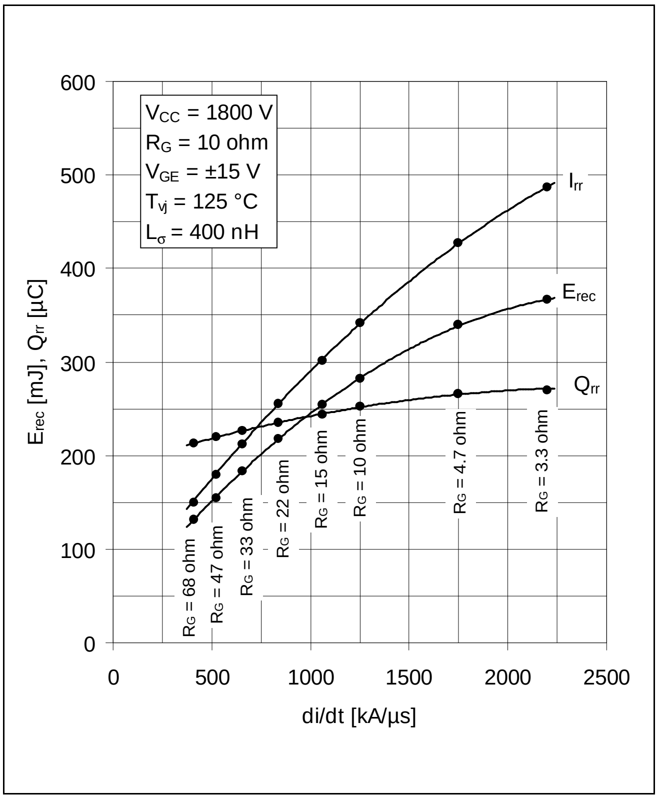


Fig. 13 Typical reverse recovery characteristics vs di/dt

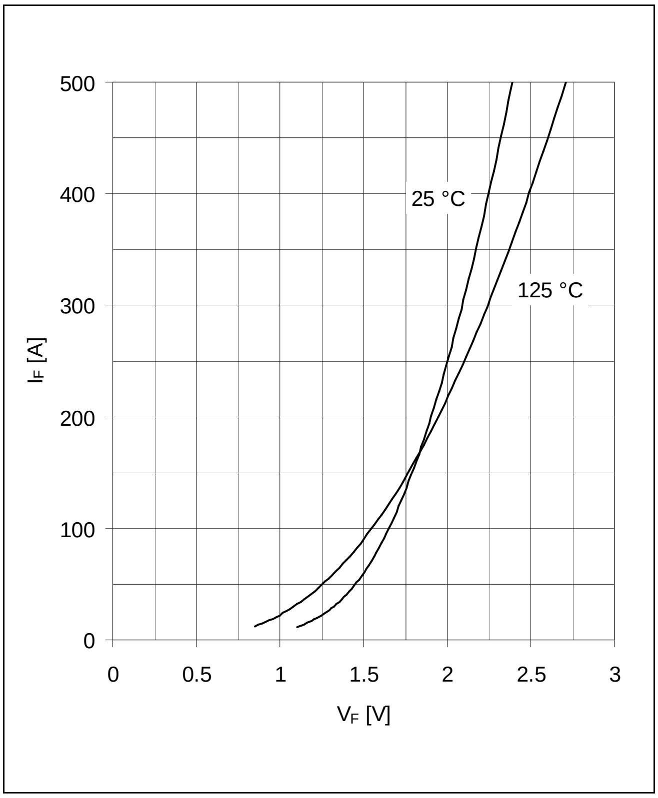


Fig. 14 Typical diode forward characteristics, chip level

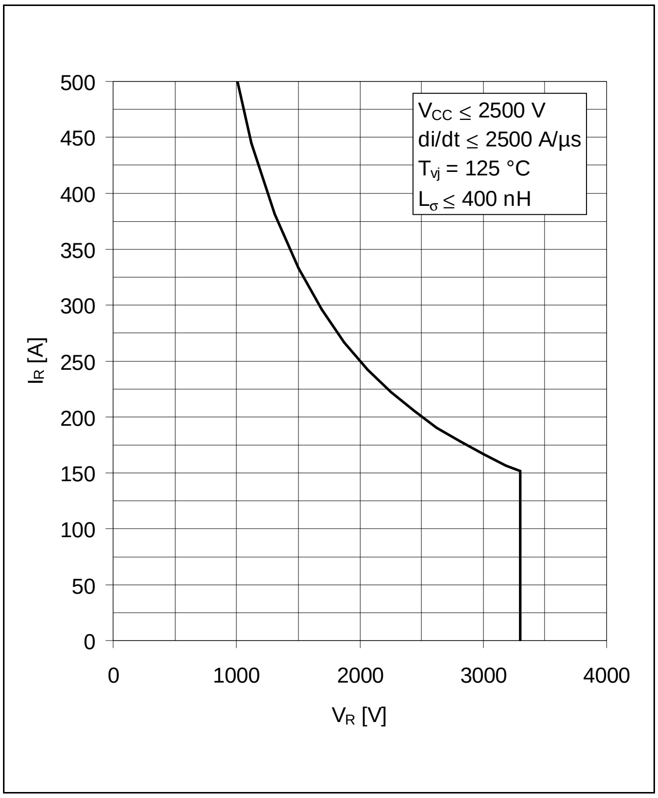


Fig. 15 Safe operating area diode (SOA)

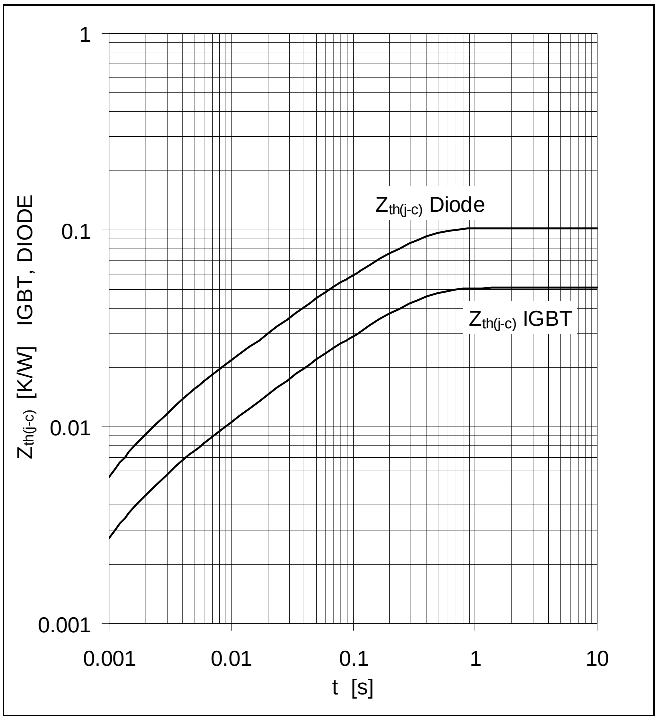


Fig. 16 Thermal impedance vs time

Analytical function for transient thermal impedance:

$$Z_{th\,(j\text{-}c)}(t) = \sum_{i=1}^{n} R_i \left(1 - e^{-t/\tau_i}\right)$$

	i	1	2	3	4	5
IGBT	R_i(K/kW)	35.1	8.25	3.85	3.79	
	τ_i(ms)	207.4	30.1	7.6	1.6	
DIODE	R_i(K/kW)	69.2	17.3	7.79	7.77	
	τ_i(ms)	203.6	30.1	7.5	1.6	

For detailed information refer to:

- 5SYA 2042 Failure rates of HiPak modules due to cosmic rays
- 5SYA 2043 Load – cycle capability of HiPaks
- 5SYA 2045 Thermal runaway during blocking
- 5SYA 2058 Surge currents for IGBT diodes
- 5SZK 9120 Specification of environmental class for HiPak

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